Ministry of Education
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Authorized by the Minister of Education

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Curriculum Guideline

Technological Studies

Intermediate and Senior Divisions, 1985

Part A

Policy for Program Planning

Contents

Preface

This document supersedes and replaces *Industrial Arts, I.19 and S.19, 1962*,[1] the subjects authorized by *Curriculum RP-35 (Occupations, Practical Subjects), 1962*, and the Intermediate Division (Grades 9 and 10) courses outlined in *Technical Subjects RP-27, 1963*. It reflects the changing skill requirements of business and industry and incorporates recommendations from the Ministry of Education's *Provincial Review of Technological Studies, 1978-79*, the *Report of the Secondary Education Review Project* (1981), and the ministry's response to the SERP report, *The Renewal of Secondary Education in Ontario* (1982). This document is also consistent with the policies outlined in the circular *Ontario Schools, Intermediate and Senior Divisions, 1984* (OSIS).[2]

Technological Studies, 1985 provides the subject guidelines and authorization for all courses and programs in technological studies from Grade 7 to Grade 12, as well as the new Ontario Academic Courses (OACs). It also suggests instructional strategies and programs for assisting students in making a successful transition from school to work.

This document is divided into three parts:

Part A provides an overview of technological studies. It outlines the course requirements common to all of the curricular areas encompassed by technological studies. All the information and directions contained in Part A must be thoroughly examined before courses are planned from Part B.

Part B provides subject guidelines for technological courses in Grades 7 to 12 and industrial arts in Grades 7 and 8; renewed guidelines for the Intermediate Division (Grades 9 and 10); and guidelines for the Senior Division (Grades 11 and 12). Some of these guidelines are based on prior guidelines; others are new. Senior Division guidelines will be added to Part B as they are updated. Boards and schools wishing to offer courses not covered by this guideline may do so by following the requirements outlined in OSIS for non-guideline courses.

Part C outlines three Ontario Academic Courses (OACs) in technological studies: Analog and Digital Electronics, Fluid Power Control, and Computer Technology. School boards may offer these courses to students who wish to continue study in a postsecondary institution or who wish to pursue careers upon graduation.

1. Courses in this subject may be taught by teachers who hold qualifications in industrial arts (general studies or technological studies). In all cases a credit given in this subject may qualify as the compulsory business or technological studies credit for an OSSD.
2. Ministry of Education, Ontario, *Ontario Schools, Intermediate and Senior Divisions (Grades 7-12/OACs): Program and Diploma Requirements, 1984* (Toronto: Ministry of Education, Ontario, 1984).

Introduction

The growing importance of information technology to business and industry means that students who participate in technological studies today require different types of skills and knowledge than students did in the past. The need for skills in the trades and service occupations continues, but there is a greater demand for knowledge and skills related to new technologies. Therefore, technological studies should prepare students for employment and postsecondary education at the same time as it provides them with a basic understanding of modern technology. The accelerated pace of change in contemporary life also requires students to develop a wide range of basic learning and job skills and the positive attitudes and feelings of self-worth that will allow them to adapt readily to changing employment requirements. These needs should be reflected in courses developed from these guidelines.

2 Program Planning at the School Level

Once the school board has developed its statement of purpose regarding technological studies and has defined strategies for delivering programs in its jurisdiction, each school must plan and review its programs. The statement of purpose from individual schools should describe the school's orientation and what it expects of students who pursue technological studies. Although a school's orientation is, to a great extent, dictated by existing facilities and resources, the review and planning period provides an opportunity for each school to reassess the types of programs it offers and to determine whether the school's facilities and resources need to be altered.

Having determined a statement of purpose, school administrators and the technological studies department head, with the assistance of the department's teachers, should plan the technological studies program. The approaches described below are intended as aids to program planning.

Intermediate Division – Exploratory Approaches

The present industrial arts programs in Grades 7 and 8 provide the first opportunity for students to explore technological studies. It is important at this level to provide an overview of secondary school opportunities in the various fields of technological studies and postsecondary career opportunities. The program provides a basic introduction through practical experience to the identification and use of hand tools, the aesthetic appreciation and design of various projects, the qualities and uses of various materials, power machinery, and basic problem-solving skills. Along with these basic skills and knowledge, stress should be placed on safe working practices and on the concept that technological studies courses are equally applicable to girls and boys. In Grades 9 and 10, further refinement and development of basic skills and knowledge should continue, with an increasing emphasis on creative problem-solving.

Traditionally, the first years of technological studies courses associated with secondary school technical and occupational programs are exploratory. A sequence of short introductory courses in a variety of trades or in technical subjects gives students first-hand opportunities to discover special aptitudes or interests they may have in any one of the technological or vocational fields. Some students, before entering Grade 9 and/or Grade 10, may be ready to select a single subject or pair of subjects that they wish to study in a more concentrated way in these grades. The increased amount of time students spend with a single subject may help them achieve more complex learning objectives than could be attained with an exploratory approach.

In all cases, exploratory courses must offer students an opportunity to learn about career possibilities and alternative training routes. By Grade 9 some students may express a desire to become auto mechanics, or machinists, or chefs, without their having experienced other fields. Other students may have no clear ideas about their occupational goals. For most adolescents, therefore, the exploratory years in the Intermediate Division are of crucial importance. Exploratory courses can help students to develop decision-making skills, to relate theory to concrete situations, to apply principles to practice, and to acquire the reflective attitudes that lead them to consider the implications of their actions.

Educational objectives for exploratory courses should be based on the relevance of the particular subjects to practical applications in the field. They should foster participation and the student's desire for excellence, an open approach to decision-making, responsible behaviour, co-operative attitudes, and self-respect.

For these objectives to be attained, the activities of each shop-round of exploratory courses should be planned in such a way that students come to see the interrelationships among them; students should not see courses as a

disconnected set of subjects. The extent of integration can, however, vary with the type of subject grouping, the number of teachers involved, and the time available.

The most integrated approach is possible in an industrial arts or other multi-activity shop or laboratory that has, in the same room, equipment related to three or more subject fields. The task of individual teachers is to relate the various subject activities and skill developments to one another, while simultaneously allowing each subject to be explored separately. Grade 10 should allow students to explore in greater depth the particular subject area in which they are most interested.

A more general approach requires planning by a group of teachers and focuses on a group of compatible subjects that can be explored usefully in combination. The grouping can be based on three or four subjects selected from any one of the nine subject groupings in Part B of this document (excluding the Materials, Processing, and Design subject grouping). For example, students can explore drafting, metal fabrication, and woodworking by completing a project or job that requires skills from all three subject areas. In such a case, joint planning by the teachers of each subject area is necessary to achieve a balance between the fulfilment of individual subject aims and the relationship of the subjects to the chosen project.

It is also possible to organize a large variety of shops into a limited number of integrated groupings. Such organization does not necessarily require a completely unified approach among the subjects. Each teacher should, however, be aware of the exploratory activities offered to students in other subjects of a particular shop-round and should know how these activities relate to one another. The links among the subjects can then be presented to students so that in understanding the relationships among the various activities, they can gain some perspective on how each contributes to an overall goal.

In general, each subject in the exploratory group of subjects should provide a minimum of one-quarter of a credit. The combination of course content offered by a school in Grades 9 and 10 for any subject listed in Part B of this document should cover the required core content and should satisfy the core aims specified in the guideline for that subject. Further information regarding exploratory courses is found in *Technological Studies, Part B: Materials, Processes, and Design Subject Grouping*.

Senior Division Courses

Guidelines and Emphases

Some of the subject guidelines in Part B authorize only Intermediate Division courses (for Grades 9 and 10). Senior Division courses in these subjects are authorized by existing Senior Division curriculum guidelines, which are listed in the respective subject guidelines in Part B. The remaining guidelines in Part B authorize courses in technological studies for both the Intermediate and Senior Divisions. In the past, there were no Senior Division curriculum guidelines for these subjects, with the exception of industrial arts.

Senior Division courses authorized by the guidelines in this document are based in part on the same aims as the Intermediate Division courses, but they expand the core knowledge, skills, and concepts outlined for the Intermediate Division. Units and topics that appear in the list at the end of each subject grouping are also included as Senior Division optional course content. Many of these optional topics are, in fact, more appropriate as Senior Division topics. Teachers may also include optional topics of their choice that are appropriate to Senior Division course work in the subject and are suitably related to the interests of particular students.

Emphasis in Senior Division courses should be placed on problem-solving and on the student's ability to work independently at assigned tasks. (In some courses, however, strategies involving well-organized teamwork may be more suitable for complex and industry-oriented projects.) To reinforce these emphases, consideration should be given to the alternative approaches outlined below.

Alternative Approaches

School-related and community-related packages

The term *school-related package* refers to a particular set of courses planned by the school to provide a curricular emphasis for students who have a specific educational goal. Such a goal could include postsecondary education or training in a particular field, direct entry into employment in a specific vocational field, or general education in a particular area of study. By collaborative planning, teachers can build mutually reinforcing relationships among courses within a particular package.

The term *community-related package* refers to a set of courses planned by the school and the community to provide students with a curricular emphasis related to the major economic base of the community. Examples of possible emphases are forestry, mining, tourism, agriculture, manufacturing, and business.

Any package having a subject of concentration in technological studies should introduce the student to skills and knowledge associated with a range of possible occupations. Such a package should support the student's plans for entering the job market either following graduation from secondary school or after additional study in a postsecondary program.

A package with concentration in technological studies may begin with an in-depth exploration of the subject in Grade 10 and then may occupy up to half of the student's program in Grades 11 and 12.

Courses in the area of concentration would be offered in each year of the package, with one or more of the courses worth two credits. Related courses in both academic and technological studies would have units, topics, assignments, and other activities specifically planned to support the area of concentration and to establish the necessary base of skill and knowledge for further education and training.

A typical package with a technological studies focus may have auto mechanics as the subject of concentration. Related courses in this package could include a selection from courses in small engines, electricity/electronics, fluid power and control, science (physics), mathematics, accountancy, and English.

In such programs, opportunities for work experience or for a co-operative education job-site placement with an employer could be planned for students.

The technological studies courses offered in a school need not be structured into packages. Some may serve as independent options and interest courses. This could apply to many of the courses in technological studies offered at the advanced level or other courses offered for general interest, such as automotive maintenance or home maintenance courses designed to meet the needs of both boys and girls.

Co-operative education

Co-operative education can provide experiences that not only enhance acquired skills but also provide students with realistic expectations of the day-to-day practices and requirements of business and industry. The parameters within which co-operative education can take place are set out in OSIS and include student experience and time in the workplace.

Boards and schools should take advantage of this opportunity to provide a more realistic link between school and work. Co-operative education can provide all students with valuable experiences in career exploration and skill development. It also provides a viable alternative for students who have difficulty

coping with a regular school environment during the normal school day. In some cases the out-of-school component may provide the necessary hands-on experience with equipment not readily available in the school.

Technological studies teachers should be directly involved in co-operative education programs. In addition to their in-school instruction, teachers should actively monitor students in out-of-school situations as part of their regular assigned duties. In this way teachers, too, can foster and maintain the necessary links with the world of work.

In all cases, the in-school and out-of-school components of a co-operative education course must maintain the integrity of the course's stated educational objectives. Both school officials and employers have a responsibility to monitor the out-of-school component to ensure that the total course objectives are being met. The establishment and maintenance of meaningful evaluation procedures are to be a co-operative effort involving the classroom teacher, the supervisor in the work setting, and the co-operative education supervisor.

Work experience

Whereas in a co-operative education course the time for the out-of-school component must be built into a student's timetable, work experience is an integrated part of a specific course. As a component of the student's course, work experience gives the student opportunities to exercise and reinforce the technical skills and knowledge acquired in school. It also provides an orientation to the workplace and opportunities for additional career exploration through discussions with experienced workers. It has been found that work experience is most beneficial to students in their third or fourth year of secondary school.

All work experiences should reflect good planning and should normally be limited to one or two weeks in any one school year. Exceptions may be made for basic-level programs, but in such cases the time on the work site should never exceed a total of four weeks in any one school year. The student does not normally receive pay when participating in work experience.

The activities and objectives of the learning experiences for the student must be discussed beforehand by the teacher and the employer or supervisor. Both the employer and the student are required to prepare evaluation reports on the student's experience.

Every precaution must be taken to ensure the safety and protection of students while they are on a job site. Planning for a work experience should, therefore, incorporate provisions for safe work stations, special instruction on safe practices and proper clothing, and the coverage required through the Workers' Compensation Board.

The Linkage program

Although listed as an alternative approach most appropriate for the Senior Division, participation in the Linkage program can begin in the Intermediate Division, particularly in some of the service trade subjects, such as hairstylist or chef.

The Linkage program aligns subject content in certain secondary school courses with training programs outlined by the Ministry of Colleges and Universities for the postsecondary level. Schools participating in the program are provided with a training profile listing specific performance objectives that must be accomplished as part of a secondary school course.

This alignment of the curriculum allows secondary school students enrolled in technological studies courses associated with the Linkage program to continue their theoretical training after graduation, with minimum overlap. The program is aimed at students who intend eventually to enter apprenticeship, a business or technical program in a college of applied arts and technology, or a modular training program. For example, students who are enrolled in auto mechanics and registered in the Linkage program and who successfully achieve the learning specified in the basic course of the in-school theoretical

training for apprenticeship are excused from this basic course if they become indentured as apprentices after graduation. As apprentices, their first in-school training assignment would be the intermediate course at a college of applied arts and technology.

All courses offered in secondary schools, whether associated with the Linkage program or not, must be based on the appropriate curriculum guideline issued by the Ministry of Education. The Linkage training profile serves in each case only as a resource for teachers to use in planning the units to include in the credit course, so that the objectives of the particular Linkage program can be met. For students, it should be made clear that registration in the Linkage program serves the following purposes:

- It allows the student to earn Ontario Secondary School Diploma (OSSD) credits while acquiring specific skills recognized for apprenticeship and knowledge in a vocational field.
- It provides the student with an opportunity to acquire training at a level sufficient for advanced placement upon entrance to postsecondary courses associated with apprenticeship.
- It provides a link between secondary school and employers' requirements.

To achieve the learning objectives specified in the training profile for a particular subject area in the Linkage program, students may be required to take courses involving from four to ten credits over a period of two or more years. Linkage program courses can, therefore, be delivered most effectively as part of a school-related package that includes appropriate English, mathematics, and science courses. Where possible, Grade 12 courses that include training profile units should also be co-operative in nature and include a closely related out-of-school component with an employer. Experience of this type can provide opportunities for students to reinforce the skills and knowledge acquired in school. It can also help them develop attitudes towards and knowledge of the workplace that foster a satisfactory transition from school to employment.

The success of the Linkage program depends to a large extent on two factors. The first is job placement in business and industry for program graduates; the second is recognition by the colleges of applied arts and technology of credits earned in secondary school courses completed through the Linkage program. Ongoing liaison between employers and college instructors and teachers in secondary school Linkage programs can significantly enhance local acceptance of the program.

Program Requirements

OSIS requires that each student complete a technological studies or business studies credit in order to be eligible for the OSSD. Any one credit, or partial credits totalling one, gained from a course or courses developed from these guidelines fulfils that requirement.

The individual guidelines in Part B of this document may stipulate prerequisite courses; some of these, however, may be waived at the discretion of the school principal especially where adult students are involved. A parent or adult student may appeal to the school board a principal's decision regarding prerequisites.

In planning courses developed from this guideline, school administrators are to consider the following:

a) levels of difficulty
b) exceptional pupils
c) language across the curriculum
d) life skills
e) information on career opportunities
f) sex equity
g) safety
h) computers
i) adult perspective
j) values

a) Levels of Difficulty

The subject guidelines in Part B provide the authority for technological studies courses, which may be offered at three levels of difficulty: basic, general, and advanced. Where courses are not authorized at a particular level of difficulty, it is possible to submit a request for approval of a non-guideline course at that level of difficulty. The request should be accompanied by all of the necessary information required for non-guideline courses, as outlined in OSIS. Courses developed at any of the three levels may be adapted to meet the learning needs of exceptional pupils. This adaptation is usually arranged by the school principal.

The general characteristics of the three levels of difficulty are as follows:

Basic level. Basic-level courses focus on the development of personal skills, social understanding, self-confidence, and preparation for the world of work. These courses help students to prepare for a successful, independent home and working life, to manage personal financial resources, to communicate effectively, and to develop attitudes that foster respect for the environment, good health and fitness, and a positive approach towards work and leisure. Technological studies courses at the basic level should provide a good preparation for direct entry into employment from secondary school.

The guidelines for basic-level courses provide latitude for the design of a range of courses at the same grade level. Thus, courses in a particular grade may be designed for selected groups of students who have varying degrees of interest and skill. Courses offered at the basic level of difficulty are not oriented exclusively towards exceptional pupils.

Basic-level courses should focus primarily on practical activities; theoretical concepts should be kept to the necessary minimum, with knowledge and concepts related directly to the practical activities whenever possible.

General level. General-level courses provide preparation for employment or for further education in certain programs in the colleges of applied arts and technology and other non-degree-granting postsecondary educational institutions. The emphasis of general-level technological studies courses is on:

- helping students to develop the attitudes, skills, and knowledge that permit them to enter directly into employment upon graduation or to enter certain programs at the colleges of applied arts and technology;
- helping students to develop the habit of learning the personal skills (problem-solving, domestic, consumer, recreational) that they may need throughout their lives;
- acquainting students with the language, assumptions, issues, and career opportunities in the various fields of technological studies and helping them to master the skills appropriate to the discipline, including the mastery of safe practices;
- stimulating students to continue to develop and increase their awareness, appreciation, and enjoyment of, as well as skill in, the arts.

Practical activities that relate to skill development and the application of theoretical knowledge should take up a minimum of 60 per cent of the course time.

Advanced level. Advanced-level courses focus on the development of academic skills and prepare students for entry into university and certain programs at colleges of applied arts and technology. Such courses should assist students in understanding the theoretical principles, practical applications, and substantive content of a subject. In technological studies, advanced-level courses should emphasize the in-depth development of thinking skills and problem-solving skills related to practical projects. The acquisition of theoretical knowledge and the exploration of concepts should take up approximately 60 per cent of the course time.

b) Exceptional Pupils

Exceptionalities are categorized in the Education Act, 1982, as behavioural, communicational, physical, intellectual, and multiple, with identification of exceptionalities to be made by a school board's identification, placement, and review committee (IPRC). Curriculum modifications for exceptional pupils must accommodate their individual needs. Some modifications may be relatively simple; others may be extensive and require the use of specially designed equipment. Additional assistance may be required for severely handicapped students.

When recommending exceptional pupils for placement in a technological studies course, the IPRC, in consultation with appropriate personnel, should consider the following questions:

- Is enrolment in the course in the student's best interest?
- Are there adequate safety precautions?
- Are the facility and equipment appropriate for the nature of the exceptionality?
- Can provision be made for adequate supervision?
- Is the teacher adequately trained and prepared to make appropriate program modifications?

An exceptional pupil's program must be based on and modified by continuous assessment and evaluation. Evaluation techniques, such as observation and teacher-student interviews, should supplement the more formal types of assessment, so that a more personal and complete picture of the student's progress may be obtained.

The following Ministry of Education publications contain suggestions on teaching strategies for pupils with various exceptionalities:

- *The Gifted Learner*, 1984
- *Children With Physical Handicaps and Health Impairments*, 1978
- *Children With Mild Intellectual Handicaps*, 1979
- *Behaviour*, 1984
- *Children With Communication Exceptionalities*, 1979
- *Vision*, 1978
- *Children With Learning Disabilities*, 1984
- *Children With Moderate and Severe Intellectual Handicaps*, 1981

c) Language Across the Curriculum

Since the language activities of reading, writing, speaking, and listening are the basic means of learning common to all subject areas, all teachers must co-operate in ensuring that the four aspects of language receive appropriate emphasis and treatment in their subject areas. A deliberate attempt should be made to foster the student's use of the specialized language and terminology of a particular discipline.

Technological studies provide many opportunities for teachers to assist students in language activities; for example, by encouraging the correct use of technical terminology; by assigning written and oral technical reports; by evaluating language in written assignments, tests, and examinations; by conducting group discussions on technical topics; and by emphasizing effective communication skills during question-and-answer periods. Students will also better appreciate teachers' efforts to promote language skills if they understand the relationship of these skills to the expectations of business and industry.

d) Life Skills

Life skills are abilities that are useful in everyday life. In addition to providing training in specific job skills, technological studies courses provide a sound basis in such life skills as the ability to carry out simple home and auto maintenance, to interpret and follow basic blueprints and plans, and to follow basic assembly instructions. As an integral part of all courses, students should also be encouraged to develop the ability to work co-operatively with others in a productive work setting, to deal positively with authority, to acquire safe and neat work habits, to

recognize the importance of punctuality and attendance, and, through taking on group leadership roles, to accept responsibility.

It is vitally important that all secondary school students be given opportunities to acquire basic life skills. Educators involved in technological studies should recognize the contribution they can make to this area of student learning.

e) Information on Career Opportunities

All students in Grades 7 and 8 must be made aware of the career opportunities available through technological studies. As well, technological studies students should have access to current information on the educational requirements for apprenticeship and other career programs and on employment opportunities. Career planning can be facilitated by providing students with access to the Student Guidance Information Service, with information on Linkage programs, and with information on projected employment trends.

For these reasons, guidance counsellors and technological studies teachers should work together to:

- provide students with the information they need to make appropriate educational decisions;
- assist students in their subject selections;
- advise students on the most appropriate training routes for meeting their needs;
- teach students job-search and interview skills.

f) Sex Equity

Equal access for male and female students to all courses in the schools is a high priority of both the Ministry of Education and society in general. Promotion of this policy in technological studies programs requires a special effort, since there is still a psychological barrier to the acceptance of sexual equality in vocational areas that have traditionally been considered the domain of either men or women.

Co-operative effort on the part of parents, students, administrators, and technological studies teachers can help overcome such stereotyping. Course calendars, newsletters, and informative presentations are useful vehicles for encouraging students to enrol in non-traditional fields. Enrolment can also be encouraged by inviting speakers who have experienced success in non-traditional educational fields and industrial occupations. Courses that appeal to both sexes, such as auto maintenance, should be offered. When planning courses of study, it is important that teachers be sensitive to the needs of both sexes.

g) Safety

A safety-conscious attitude among students not only minimizes accidents in the school but also reduces the rate of accidents young people experience in their first job. Helping students to develop continual awareness and practice of good safety habits and the ability to apply accident-prevention techniques in their daily activities must be among the aims of all technological studies courses. In support of these aims, the Industrial Accident Prevention Association (IAPA) advocates the use of portions or all of their school safety-awareness program. For details teachers should contact their local IAPA office.

All educators involved in technological studies should be familiar with the relevant provisions of the Occupational Health and Safety Act, 1978, and the regulations for industrial establishments made under that Act. These provisions relate to safety standards, the monitoring and enforcement of safe practices, the role of health and safety representatives and committees, and employers' and workers' responsibilities for ensuring a safe working environment. Many of these provisions, such as those pertaining to the health and safety committee, can be applied to the classroom setting, with benefit to all participants.

Teachers of technological studies have a unique role to play in developing proper safety attitudes and work habits in students. A class program on safety introduced at the beginning

of any course should focus on general procedures, rules, and formal school-board safety policy. It is suggested that the formal safety policy be formulated by a local group of technical directors, teachers, administrators, and representatives from business and industry. All teachers affected by these safety guidelines should be involved at some stage of the development process.

The school-board safety policy should include provisions for a regular review of that policy. Periodical assessment of the effectiveness of existing safety policy is necessary to accommodate experience as well as changes in both technology and instructional practice.

To ensure a safe educational or industrial working environment, students must adhere to proper practices in each training situation and demonstrate their knowledge of the proper use of the tools, machinery, and equipment of the workplace. Dull, broken, or improperly adjusted hand tools are a major cause of minor injuries in practical training situations. Safety practices must also be specified for individual pieces of power equipment. Respect for the standard working space designated around each machine should be enforced, and the need for working with proper guards in place must be emphasized.

Students must be made aware of the hazards of improper grooming and dress when working around or with machines. When preparing for a work period, they must use appropriate protective equipment and devices, such as goggles, gloves, aprons, ear protectors, helmets, and boots.

For a safety program to be effective, the classroom teacher must act as a role model by adhering to all those safe practices that he/she is trying to impart to the students.

h) Computers

Much has already been said about the introduction and use of computers in our society and about the impact they may have on the educational system. School administrators face major decisions regarding the implementation of computer studies programs within their schools. These decisions are to be based on the availability of facilities, equipment, and teacher expertise.

In technological studies, it is necessary to decide whether to offer a discrete course in computer technology or to integrate computer concepts into the electronics and electricity program. Other technological studies courses also require integrated topics relating to the use of computers in their subject fields. Suggestions regarding equipment and teacher and student activities are outlined under "The Provision of Resources" in section 1.

The use of computers as an aid in student instruction must also be recognized. As more computer software is developed for individual subject areas, its use will be determined by the availability of computers for the classroom and the expertise of the classroom teacher. In this area the teacher's main responsibilities are to know what software is available, to determine the most useful software for his/her course, and to be able to instruct students in the basic operation of the computer.

The guideline *Computer Studies, Intermediate and Senior Divisions, 1983* should be consulted for further information.

i) The Adult Perspective

Adult learners in the regular day school may be grouped in classes composed exclusively of adults or integrated with regular school age students. Relatively small adjustments in planning may provide substantial benefits for adult learners as well as enrich the experiences of regular students.

In designing curricula and courses of study, teachers should adopt content and strategies that meet the needs of adult learners as well as take advantage of their characteristics. The following are some characteristics of adult learners:

- Most consider formal learning as subsidiary to their primary role, which is mainly socially oriented (e.g., mother, father, community citizen). Their enrolment in formal learning programs is basically voluntary and usually on a part-time basis.

- They tend to have broad experience, come from a variety of backgrounds, and have different interests, attitudes, levels of formal education, occupations, ages, and family responsibilities.
- They are motivated to undertake formal learning for a definite purpose. They see the need for programs that can help them in their present careers or are at a stage in their life cycle or job cycle that requires a new direction.
- Their individual differences are usually more pronounced than those of school-age children. Adults tend to have entrenched habits of learning that have been acquired through their experiences.
- They exhibit physiological changes to a greater extent than do adolescents. They are in various stages of the aging process and may suffer from reduced vision and hearing.

Technological studies provide an opportunity for interaction between adult learners and regular day students, simulate real work situations, and promote better understanding among various age groups. Teachers should take advantage of the characteristics listed above and modify teaching and learning techniques to accommodate adults within the classroom. Although the following suggested techniques are suitable for most classroom situations, they are especially critical for programs that include adult learners:

- Learning objectives should be reasonable, rational, relevant, and purposeful.
- The level of language used in instructing adult learners should reflect their level of maturity.
- The specialized expertise of adult learners should be utilized in the classroom.
- Small-group discussions and individualized learning methods should be provided.
- Self-direction should be encouraged by providing learners with increased responsibility for task analysis, course content, and evaluation methods.
- Courses should be provided at appropriate levels of difficulty, since the learning abilities of adults vary as much as do those of adolescents.
- A variety of media modes should be used, with students participating actively in presentations.
- The learning environment should make adults feel comfortable. Intimidating institutional classroom settings are to be avoided.
- Immediate feedback should be provided and regular encouragement offered in order to sustain students' motivation.
- A broad range of evaluation methods, both formative and summative, should be used. (See "Evaluation" at the end of section 3, "Course Planning at the Department Level".)

Programs and courses can also be adjusted to suit returning students. Provision may be made for modules for fractional credits, short intensive courses, orientation courses, non-traditional timetables, the incorporation of Linkage programs, and continuing education courses.

j) Values

Values education occurs as an integral part of the school experience. It is part of the study of all subjects at all levels. In technological studies programs teachers should provide regular opportunities to reflect upon the values and issues that arise from the subject matter, from the learning activities, and from students' relationships in the classroom and the workplace. These opportunities are intended to help students examine and clarify values within a social context and to develop reflective skills, which can assist them with the value dilemmas they may experience in their personal lives.

In the classroom, reflection on values and issues should take place in an atmosphere of fairness, respect, and caring. Students should be challenged to consider the ethical implications of decisions and to become increasingly aware of both the individual's rights and responsibilities.

3 Course Planning at the Department Level

Statements of Purpose

The paragraphs under ''Statements of Purpose'', p. 8, and the opening paragraphs of section 1, ''Program Planning at the School Board Level'', and section 2, ''Program Planning at the School Level'', discuss the statements of purpose at the board and school levels. This section describes the statements of purpose for individual subjects at the department and classroom level. Statements designed by teachers in consultation with their department head should reflect expected student outcomes. Such outcomes might include the following: preparing students for general employment, for apprenticeship and trades, and for further education; or developing students' general understanding of a topic in order to assist them in their roles of user, producer, or repairer. Course planning should then follow logically from the statement of purpose.

Planning the Sequence of Courses in a Program

Each subject guideline in Part B outlines aims and core content. Intermediate Division course requirements, based on a minimum scheduled time of 110 hours, may be met through a single course or through a sequence of two courses over two years. When course material is presented over two years, it may be introduced in an exploratory way in a short course in the first year, followed by a longer, in-depth treatment of the material in the second year. Where the aims and core content are divided over the two years or where they are completely covered in each course, two courses of equal length may be offered, with the depth of treatment increasing in the second year. These alternative approaches to meeting course requirements are applicable to all subjects in technological studies in the Intermediate Division.

A combination of Intermediate and Senior Division courses associated with the same subject forms a program of technological studies. In such programs the Intermediate and Senior Division courses share the same aims and follow a natural learning sequence.

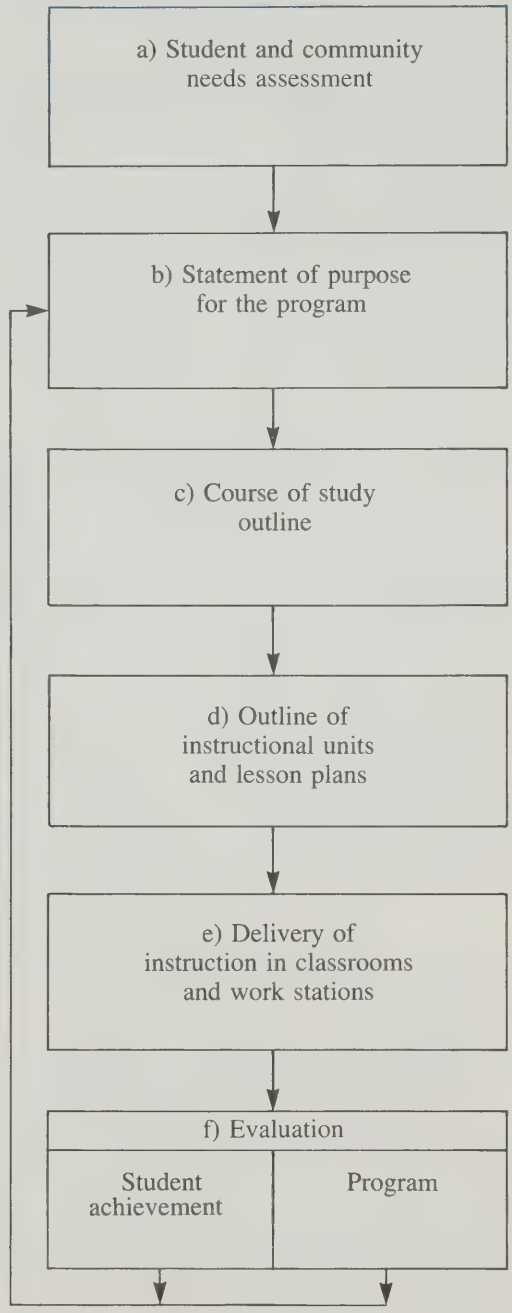
Planning and Revising Courses: The Steps Model

Before a course of study is prepared, it is necessary to:

- review statements of purpose at the board and school levels;
- assess the needs of students and the community in the particular subject fields of technological studies;
- identify the program purpose and general objectives that the course is planned to support;
- analyse and identify the training and knowledge required in the particular field of technological studies;
- provide a statement of purpose for that subject at the classroom level.

The steps model (see next page) outlines the sequence to follow in developing technological studies courses.

Steps Model for Planning and Revising Courses in Technological Studies



a) Student and community needs are determined through input from business and industry, postsecondary institutions, community groups, students, parents, the school, and the board.

b) The statement of purpose for the program (e.g., woodworking) is based on an assessment of community needs, the goals of education, the aims of technological studies, the policy of the board and the school, and the educational philosophy of the staff in the department of technological studies at the school.

c) The course of study outline is based on the subject guideline as well as any training profile (i.e., Linkage) and reflects the statement of purpose for the program. It provides information on the level of difficulty of the course, a course description, general course objectives, a course content outline including material on safety, an approximate timing for course components, student evaluation criteria, an indication of credit value, and a list of the resources required. Copies should be retained by the teacher, department head, and principal, and should be available for examination by students and parents upon request.

d) Planning for the outline of instructional units and lesson plans is based on the course of study outline; the subject guideline, and trade analyses and/or training profiles. It includes specific performance objectives for core and optional content; teaching strategies and themes (projects, jobs, experiments, problems, etc.); and the sequencing of topics, assignments, and evaluation plans.

e) Delivery of instruction in classrooms and work stations reflects implementation of the planning carried out in step (d). It requires co-ordination of facilities, tools, equipment, and supplies, and allocation of available time between instruction and practical applications at work stations.

f) Evaluation is an ongoing process. Student performance and input acquired through the follow-up of graduates can be helpful in program modification.

The activities described in steps (a) and (b) are, to a large extent, the responsibility of school board officials and school administrators working in co-operation with appropriate technological studies teachers. Many of the activities described for the review and planning of technological studies apply here. Data gained from program evaluation in such areas as enrolment, job placement, and career opportunities should also be used for course planning.

Once course offerings have been determined for individual schools, the development of courses (described in steps (a) to (f)) can be undertaken by a group of teachers working together at the board or school level or by individual teachers. The methods, processes, and materials outlined in this document may be extended to suit the specialized requirements of particular communities and schools.

Developing a Course of Study Outline

The course of study outline should contain the name of the guideline on which the course is based, a broad description of the course, information on the level of difficulty, general objectives of the course, and subject content headings. Time requirements, credit value, and key resources are also to be identified in a general way.

The *course description* should provide a statement of the general aims of the course in relation to the school's technological studies program. It should further identify the particular technological, trade, or service emphasis of the course work and should link the course's potential application to particular vocational or further training options. The description should indicate for whom the course is intended (e.g., that it is an introductory course at the general level of difficulty for students entering Grade 9 or Grade 10). Any additional information that would be useful to students, such as the need for or desirability of a particular prerequisite for the course or special modes of delivery, should also be indicated.

The *general objectives* of the course should be specified under a separate heading. These should focus on the broad areas of competence to be acquired by students and should include the specific core aims identified in the appropriate subject guideline in Part B of this document. For some courses these objectives should also reflect the general performance standards identified by industry. More specific performance objectives or enabling objectives are generally developed by teachers as part of the units of instruction and the outlines for daily lesson plans.

The *subject content* of the course is the third major component of the course of study. This component may appear as topic headings, as a list of skills and knowledge, or as a combination of these. The core content identified in the subject guideline (Part B) should be listed, along with the optional content planned for the course. Some guide to the time allocation for each unit of content is essential. These times are to be approximate, because some flexibility is required to meet the specific training needs of different groups of students within the timetable allotment. The criteria for evaluating student achievement in the course should also be indicated.

The resources required for the course should also be outlined briefly. In technological studies these resources fall into four categories: texts, reference books, and audio-visual materials; appropriate equipment and tools; supplies; and shop or laboratory facilities. Recommendations for resources should focus on the major elements essential for teaching the topics listed under the subject content.

Outline of Instructional Units and Lesson Plans

The outline of instructional units and lesson plans reflects the teacher's management strategy for the course and is the responsibility of the individual teacher. The outline should identify:

- the organization of the instructional units that make up the course;
- the sequence of lesson plans for each unit;
- the specific learning objectives to be achieved by students;
- the teaching strategies to be employed;
- the strategies for evaluating student achievement.

In the preparation of the outline, the subject content in the course of study is first organized into a set of instructional units. Each unit deals with a section of the content, focuses on one or more of the listed topics or skills, and introduces the necessary elements for accomplishing the course objectives. Training profiles or trade analyses are particularly useful resources at this stage.

In the planning of units and lessons, the subject content needs to be translated into precise statements describing the skills, knowledge, and attitudes that students are expected to gain from the course. The action statements (learning objectives or student performance objectives) developed for the lesson are narrower in scope than is the objective for the unit. In each case, however, the statements must reflect the abilities, needs, and interests of the students for whom the course is planned.

In establishing the order of the units and the sequence of daily lesson plans for each unit, the teacher should aim for a perspective on the subject as a whole. Interest and achievement can be maintained when students are aware of the organization and direction of their courses.

Teaching strategies must be planned to integrate the theoretical knowledge requirement with the practical aspects of a course. Such strategies can include a variety of approaches (e.g., individual or group projects, sets of problems to be solved, experiments, major assignments, or any combination of these) that can be applied in sequence or simultaneously. For example, developing a course around the project or theme of ''rebuilding a chair'' is a strategy that effectively interrelates the skills and knowledge students may acquire during a Grade 10 upholstery course. Similarly, a strategy based on the themes ''developing the power'' and ''controlling the power'' in a Grade 10 auto repair course interrelates the wide range of knowledge and skills that may be included in the content of such a course.

Evaluation

Step (f) of the steps model indicates that evaluation is a two-part activity. The first part involves assessment of students' progress and performance and is aimed at determining the extent to which students have:

- learned the required course content;
- developed desirable attitudes and understanding;
- acquired the necessary technological skills and knowledge.

This ongoing assessment of student achievement reflects the planning described in step (d). The outline of instructional units and lesson plans should also include plans for evaluating student achievement. Where mastery of particular subject content is required, ongoing assessment can contribute significantly to the learning process. In other cases the ability to interrelate subject theory and practical skills may be assessed through student achievement on projects, demonstrations, or problem assignments that involve

practical applications of the subject content. Course objectives related to the skill areas of project work may, in some cases, be assessed co-operatively by the teacher and student.

A skills-oriented program developed according to the steps model is structured largely on a set of well-stated performance objectives that describe the expected level of student achievement. The criteria contained within the objectives should reflect the program standards against which student achievement is measured.

The standards of achievement set for a particular course and level of difficulty should be related to the age and ability of the students and should take into account the competence of the students entering the course or program. Adjustments may, however, be required in the time allocated for students to reach these standards and in the number of objectives planned for the course.

The theoretical knowledge students acquire in various subjects is usually evaluated through tests and examinations. Although the objective type of test (e.g., true-false, multiple-choice, matching, and completion) is widely used, a variety of evaluation techniques should be applied because evaluations are only estimates of students' learning and must be seen as such. The language of the tests or examinations should be at the students' level of understanding and should reflect the wording used by the teacher in the classroom. The form of evaluation should be appropriate for measuring the learning objectives. Formative evaluation identifies difficulties in time to allow for remedial action.

At the beginning of any course, students must be made fully aware of the evaluation criteria to be used.

Technological studies help develop skills needed on the job, in the home, and for leisure-time activities. Evaluation of these skills involves the evaluation of both process and product. Checklists that identify clearly each sequential step are commonly used for evaluating the process, while rating scales are used to evaluate the final project. If properly developed, students can use these devices for peer or self-evaluation, to help them develop a sense of self-worth and independence, and to recognize acceptable standards of competence. Performance tests that require students to perform specific tasks are also valid and reliable methods of assessing skills.

When course objectives are being planned, valid and reliable peer and self-evaluation criteria should be developed as part of a technological studies department's policy. These criteria should be made known to the school principal and to the students involved in the programs.

The second part of step (f) in the steps model involves ongoing program evaluation intended to determine whether a course is meeting the purposes for which it was planned. When revision is indicated, evaluation of the program should point out the direction of change. Course evaluation also provides teachers with a measure of the effectiveness of their teaching strategies and learning materials so that the future shape and content of courses can be determined.

Every individual expects something of the school system and its technological studies program. Program evaluation should recognize and respond to the expectations and suggestions of people in the community who have expressed views on the goals of a technological studies program and the effectiveness of existing programs. Consideration of criticisms, ideas, praise, and expectations can lead to modifications and general improvements in the program. Soliciting views from community groups through discussion or an opinion survey can also facilitate the implementation of new initiatives such as co-operative education, or increase understanding and acceptance of the Linkage program.

Data on the pattern of enrolment experienced in technological studies courses over the years also provide useful information. Analysis of this information makes it possible to identify the courses that have been most appealing to students and those that require

reassessment. As well, a student follow-up program can provide data on the career placement and progress of former students. In this way significant information can be obtained for evaluating departmental aims and objectives. In all cases, it is important to consider student feedback elicited at the conclusion of the course.

The revision of current technological studies programs should reflect an awareness of career opportunities throughout the province and within the local community. The range of careers available either through apprenticeship programs or post-secondary studies should be discussed with and understood by students in the early stages of the Intermediate Division program. Teachers of technological studies and guidance personnel should work together in this important endeavour.

In summary, for evaluation to be most effective, reporting is necessary in several directions: from student to teacher; from teacher to student; and from teacher to colleagues, parents, and the community. Effective communication, not only of performance, but also of goals, expectations, and criteria for evaluating performance is needed. Students should understand the immediate purpose of their studies, the standards expected of them, and the ways in which they can demonstrate their acquired skills and knowledge to themselves and to others.

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